

ART. VI.—*Synopsis of the Australian Calcareo Heterocœla ;  
with a proposed Classification of the Group and  
Descriptions of some New Genera and Species.*

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1. INTRODUCTORY REMARKS.

Owing to the reduction of the Government grant to the Royal Society, it has been found impossible at present to continue the publication of the volume of the Transactions which the Council of the Society generously set apart for "A Monograph of the Victorian Sponges." Under these circumstances the Council has kindly agreed to my proposal to divide the work by publishing in the Proceedings of the Society only the necessary systematic portion, without illustrations, and publishing the anatomical portions, for which numerous illustrations are indispensable, elsewhere. It is hoped, however, that the continuation of the Monograph in its original form may be carried out at some future date.

I have in my possession, in addition to the very fine series of Victorian Heterocœla collected by Mr. Bracebridge Wilson, a number of very valuable specimens, including several remarkable new species, from other parts of Australia, and it seemed desirable to incorporate descriptions of these in the present communication. I have also a number of fragments of type specimens, generously forwarded to me by the authorities of the British Museum, which brings the total number of species of Australian Calcareo Heterocœla in my collection up to forty-seven.

Up to the present time sixty-two species of this group of sponges have been described from Australian seas, chiefly by Hæckel, von Lendenfeld, Poléjaeff and Carter. Sixteen new species are described in the present paper, which brings the total number of Australian species of *Calcarea Heterocœla* up to seventy-eight. In order to make the work as complete as possible, I have decided to include, not only descriptions or notes of the forty-seven species which I have been able to study for myself, but also references to those species which I have not seen, and thus to provide a complete Synopsis of the Australian *Calcarea Heterocœla*.

In order to arrange the species satisfactorily, I have been obliged to adopt a classification which has many new features. This classification has not been arrived at hastily, nor without careful consideration of the work of previous writers. It is impossible to justify it fully in this place, because it is based upon a minute study of anatomical details and a careful consideration of historical questions of priority in nomenclature into which I have not space to enter. I intend, however, to publish a paper on the minute anatomy and classification of the group in another place, in which these questions will be fully discussed; and, in the meantime, I may perhaps point out that the classification proposed is based upon the careful anatomical examination of a very large number of species.

It will be seen that more stress is laid upon the arrangement of the skeleton than is usual at the present day, and less upon the form and arrangement of the flagellated chambers, which I find to vary considerably, even within the limits of a single species. This change certainly facilitates the identification of specimens, and will probably be welcomed by those workers who have not at their disposal the elaborate appliances required for the preparation of stained microscopical sections.

Poléjaeff\* clearly showed that no hard and fast line could be drawn between the Sycons and Leucons of Hæckel. This idea was followed up by von Lendenfeld, who has created a special group, the *Sylleibidae*,† to include the intermediate forms. This group, however, seems to me to be very artificial, as, judging from my own observations, it appears that

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\* Report on the *Calcarea* of the Challenger Expedition.

† See especially "Die Spongien der Adria. I. Die Kalkschwämme." *Zeitschrift für Wissenschaftliche Zoologie*, Vol. 53, 1891.

the transition from the Sycon to the Leucon type of canal-system has not taken place along a single line of descent, but along several. Here, as in other cases, we must classify by an assemblage of characters. The canal-system alone is by no means sufficient, though, when taken in conjunction with the skeleton, it is often of great value.

In enumerating the various genera and species I have not attempted to give a complete list of synonyms and references, as this would have taken up a large amount of space. In the case of the species, however, I have given those synonyms and references which are most important.

My warmest thanks are due to Mr. J. Bracebridge Wilson for the bulk of the specimens here described, to Mr. Thos. Whitelegge for a very valuable collection from Port Jackson, to the Adelaide Museum for some very interesting specimens from St. Vincent's Gulf, to Professor Spencer for a number of specimens from Port Jackson, to Sir Frederick McCoy for permission to examine the collection in the Melbourne National Museum, and to Dr. Günther for fragments of type specimens in the British Museum.

## 2. PROPOSED CLASSIFICATION OF THE CALCAREO HETEROCELA.

### ORDER HETEROCELA, POLÉJAEFF.

Calcareous sponges in which the collared cells are confined to more or less well-defined flagellated chambers.

#### FAMILY I.—LEUCASCIDÆ.

Flagellated chambers very long and narrow, copiously branched; communicating at their proximal ends with exhalant canals which converge towards the oscula; their blind distal ends covered over by a dermal membrane pierced by true dermal pores which lead into the irregular spaces between the chambers. Skeleton consisting principally of small radiates irregularly scattered in the walls of the chambers and exhalant canals and in the dermal membrane.

GENUS I.—*Leucascus*, nov. gen.

*Diagnosis.*—The same as that of the family.  
(For species see Part 3 of the present paper.)

FAMILY 2.—SYCETTIDÆ.

Flagellated chambers elongated, arranged radially around a central gastral cavity, their distal ends projecting more or less on the dermal surface and not covered over by a continuous cortex. Skeleton radially symmetrical.

GENUS II.—*Sycetta* (Hæckel, *emend.*)

*Diagnosis.*—Radial chambers not inter-communicating. Articulate tubar skeleton. No tufts of oxea on the distal ends of the chambers.

(For example see Part 3 of the present paper.)

GENUS III.—*Sycon* (Risso, *emend.*)

*Diagnosis.*—Radial chambers not inter-communicating. Articulate tubar skeleton. The distal ends of the chambers provided each with a tuft of oxote spicules.

(For examples see Part 3 of the present paper.)

GENUS IV.—*Sycantha*, von Lendenfeld.

Radial chambers long, united in groups; those of each group inter-communicating by openings in their walls and each group with a single common opening into the gastral cavity. The radial chambers have freely projecting distal cones surmounted by oxote spicules. Tubar skeleton articulate.

No Australian species of this genus has yet been found. The type is von Lendenfeld's *Sycantha tenella*.\*

FAMILY 3.—GRANTIDÆ.

There is a distinct and continuous dermal cortex covering over the chamber layer and pierced by inhalant pores.

\* "Die Spongien der Adria. I. Die Kalkschwämme," p. 51.

There are no subdermal sagittal triradiates or quadriradiates.\* The flagellated chambers vary from elongated and radially arranged to spherical and irregularly scattered, while the skeleton of the chamber layer varies from regularly articulate to irregularly scattered.

GENUS V.—*Grantia* (Fleming, *emend.*)

*Diagnosis.*—The elongated flagellated chambers are arranged radially around the central gastral cavity; they are not provided with tufts of oxea at their distal ends, but are covered over by a dermal cortex composed principally of triradiate spicules and without longitudinally disposed oxea. An articulate tubar skeleton is present.

(For examples see Part 3 of the present paper.)

SUB-GENUS.—*Grantiopsis*, nov.

*Diagnosis.*—The sponge has the form of a greatly elongated, hollow tube, whose wall is composed of two distinct layers of about equal thickness. The outer (cortical) layer is provided with a very strongly developed skeleton of radiate spicules and contains the narrow, ramifying inhalant canals. The inner (chamber) layer is formed by elongated radial chambers arranged very regularly side by side. The skeleton of the chamber layer is very feebly developed; the normal subgastral triradiates are replaced by quadriradiates; the tubar skeleton is articulate, and composed of very abnormal sagittal triradiates whose paired rays are greatly reduced.

(For species see Part 3 of the present paper.)

GENUS VI.—*Ute* (Schmidt, *emend.*)

*Diagnosis.*—The ends of the elongated radial chambers are covered over by a well developed cortex, consisting in great part of large oxeote spicules arranged parallel to the long axis of the sponge. The tubar skeleton is articulate or else composed entirely of the basal rays of subgastral triradiates.

(For examples see Part 3 of the present paper.)

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\* I propose these names for spicules lying beneath the dermal surface and with inwardly directed basal or apical rays as the case may be. Such spicules are of great importance for purposes of classification.

SUB-GENUS.—*Synute*, Dendy.

*Diagnosis.*—Sponge compound, consisting of many *Ute*-like individuals completely fused together and invested in a common cortex composed largely of huge oxecote spicules.

(For species see Part 3 of the present paper.)

GENUS VII.—*Utella*, nov. gen.

*Diagnosis.*—Flagellated chambers elongated, arranged radially around the central gastral cavity. There are no longitudinally arranged oxea in the dermal cortex, but a layer of oxecote spicules lies beneath and parallel to the gastral surface. The tubar skeleton is articulate.

I propose this genus for Hæckel's *Sycandra hystrix*.\* Schmidt's *Ute utriculus* (the *Sycandra utriculus* of Hæckel†) may perhaps also be included therein.

No Australian species are as yet known.

GENUS VIII.—*Anamixilla* (Poléjaeff, *emend.*)

*Diagnosis.*—Flagellated chambers elongated and radially arranged. There is no special tubar skeleton, the skeleton of the chamber layer consisting of large radiate spicules, arranged without regard to the direction of the chambers, and of the outwardly directed basal rays of subgastral triradiates.

(For species see Part 3 of the present paper.)

GENUS IX.—*Sycyssa*, Hæckel.

*Diagnosis.*—The flagellated chambers are elongated and arranged radially around the central gastral cavity. The skeleton consists exclusively of oxecote spicules.

The only known species of this genus is Hæckel's *Sycyssa huxleyi*,‡ from the Adriatic.

GENUS X.—*Leucandra* (Hæckel, *emend.*)

*Diagnosis.*—The flagellated chambers are spherical or sac-shaped, irregularly arranged and communicating with the

\* Die Kalkschwämme. Vol. II, p. 375.

† *Loc. cit.*, p. 370.

‡ *Loc. cit.*, p. 260.

gastral cavity, or main exhalant canals, by a more or less complicated canal-system. The skeleton of the chamber layer is irregular.

(For examples see Part 3 of the present paper.)

GENUS XI.—*Lelapia* (Gray, *emend.*)

*Diagnosis.*—Canal system unknown. Skeleton of gastral surface composed of ordinary radiates. Skeleton of dermal surface composed of triradiates, quadriradiates and minute oxea. Skeleton of the chamber layer composed of large, longitudinally arranged oxea, crossed at right angles by bundles of tuning-fork-shaped triradiates whose oral rays are directed towards the gastral cavity, while the basals point towards the dermal surface.

(For species see Part 3 of the present paper).

GENUS XII.—*Leucyssa*, Hæckel.

*Diagnosis.*—Flagellated chambers (presumably) spherical or ovoid, irregularly arranged. Skeleton composed solely of oxeote spicules.

No species of this remarkable genus are as yet recorded from Australian seas, the only examples being Hæckel's *Leucyssa spongilla*, *L. cretacea* and *L. incrustans*.\*

FAMILY 4.—HETEROPIDÆ.

There is a distinct and continuous dermal cortex covering over the chamber layer and pierced by inhalant pores. Subdermal sagittal triradiates are present. The flagellated chambers vary from elongated and radially arranged to spherical and irregularly scattered. An articulate tubar skeleton may or may not be present.

GENUS XIII.—*Grantessa* (von Lendenfeld, *emend.*)

*Diagnosis.*—The flagellated chambers are elongated and arranged radially around the central gastral cavity. The dermal cortex consists principally of triradiates and does not contain longitudinally disposed oxea.

(For examples see Part 3 of the present paper.)

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\* *Loc. cit.*, pp. 137, 138, 139.

GENUS XIV.—*Heteropia* (Carter, *emend.*)

*Diagnosis.*—The distal ends of the elongated radial chambers are covered over by a well-developed dermal cortex, consisting principally of large oxea arranged parallel to the long axis of the sponge.

I propose to retain this generic name for Carter's *Aphroceras ramosa*,\* which he observes belongs to his genus *Heteropia*. No species are yet known from Australia.

GENUS XV.—*Vosmaeropsis*, *nov. gen.*

*Diagnosis.*—Flagellated chambers spherical or sac-shaped, never truly radial. Dermal cortex composed principally of triradiates, without longitudinally disposed oxea.

(For species see Part 3 of the present paper.)

## FAMILY 5.—AMPHORISCIDÆ.

There is a distinct and continuous dermal cortex covering over the chamber layer. Subdermal quadriradiates are present. The flagellated chambers vary from elongated and radially arranged to spherical and irregularly scattered.

GENUS XVI.—*Heteropegma* (Poléjaeff, *emend.*)

*Diagnosis.*—The flagellated chambers are elongated and arranged radially around the central gastral cavity. There is a vestigial tubar skeleton of minute radiates. The dermal cortex is very thick, composed principally of large triradiate spicules.

(For species see Part 3 of the present paper.)

GENUS XVII.—*Amphoriscus* (Hæckel, *emend.*)

*Diagnosis.*—The flagellated chambers are elongated and arranged radially around the central gastral cavity. The skeleton of the chamber layer is composed exclusively of the apical rays of subdermal and subgastral quadriradiates.

(For examples see Part 3 of the present paper.)

GENUS XVIII.—*Syculmis* (Hæckel, *emend.*)

*Diagnosis.*—The flagellated chambers are elongated and arranged radially around the central gastral cavity. The

\* Proc. Lit. Phil. Soc. Liverpool, Vol. XL, Appendix, 1886, p. 92.



skeleton of the chamber layer is composed of the apical rays of subdermal and subgastral quadriradiates. There is a root-tuft of oxea and anchoring quadriradiates.

The only known species of this remarkable genus is Hæckel's *Syculmis synapta*,\* from Bahia.

GENUS XIX.—*Leucilla* (Hæckel, *emend.*)

*Diagnosis.*—Flagellated chambers spherical or sac-shaped, never truly radial.

(For examples see Part 3 of the present paper.)

GENUS XX.—*Paraleucilla*, nov. gen.

*Diagnosis.*—Chambers spherical or sac-shaped (?). Beneath the dermal cortex a series of subdermal cavities supported by an outer and inner layer of quadriradiates whose apical rays cross each other in opposite directions. Beneath these comes the chamber layer, whose skeleton consists of irregularly arranged quadriradiates. Large, longitudinally arranged oxea occur between the triradiates of the dermal cortex.

(For species see Part 3 of the present paper.)

3. SYNOPSIS OF THE AUSTRALIAN SPECIES OF CALCAREA  
HETEROCELA.

1. *Leucascus simplex*, n. sp.

Sponge usually more or less flattened, cushion-shaped, spreading, with convex upper surface; sometimes becoming almost globular. Oscula irregularly scattered on the upper surface, one or several, varying in size, naked. Surface smooth. The largest specimen is a rather thin, ovoid, flattened crust, which, from its shape, appears to have grown on a crab's back; it is about 35 mm. long, 20 mm. broad, and only about 2 mm. thick in most parts; the other specimens, though smaller, are much thicker, one being nearly spherical. The surface is covered by a thin, pore-bearing dermal membrane.

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\* Die Kalkschwämme, Vol. II, p. 288.

The flagellated chambers (if one may use the term) are greatly elongated, tubular and copiously branched; their terminal branches end blindly beneath the dermal membrane. Their walls are thin and pierced by numerous prosopyles. There is no central gastral cavity but the chambers open into exhalant canals, devoid of collared cells, which converge towards the oscula. The scattered dermal pores lead into wide, irregular spaces between the tubular chambers.

The skeleton is extremely simple, consisting of small, regular triradiates, irregularly scattered in the walls of the chambers and exhalant canals, and in the dermal membrane. All the spicules are alike, except that some exhibit an incipient apical ray. The rays are straight, conical, fairly sharply pointed; measuring about 0·1 by 0·01 mm.

*Localities.*—Near Port Phillip Heads (Stations 1 and 5, coll. J. B. Wilson); Watson's Bay, Port Jackson (coll. T. Whitelegge).

## 2. *Leucascus clavatus*, n. sp.

The type specimen of this species is a sub-globular sponge about 14 mm. in maximum diameter, with a single rather wide osculum. It very closely resembles *L. simplex* in general appearance, canal system and skeleton, and the only point of distinction of any importance which I have been able to find consists in the presence in *L. clavatus* of large club-shaped oxea lying at right angles to and with the club-shaped extremity projecting slightly beyond the dermal surface. These spicules attain a length of about 0·7, and a diameter, in the thickest part, of about 0·1 mm. The outer end of the spicule is usually more or less rounded off and slightly curved, while the inner portion is straight and tapers gradually to a sharp point. The triradiates are like those of *L. simplex*, and of nearly the same size, perhaps a little larger on an average.

A second specimen is irregularly lobate, and differs from the type in its much denser texture, which is due to the stronger development of the mesoderm. It contains very numerous embryos, which fact may be associated with the strong development of the mesoderm.

*Locality.*—Near Port Phillip Heads (coll. J. B. Wilson).

3. *Sycetta primitiva*, Hæckel.

*Sycetta primitiva*, Hæckel. Die Kalkschwämme, Vol. II, p. 237.

*Locality*.—Bass Straits, Gulf of St. Vincent (Hæckel).

4. *Sycon coronatum*, Ellis and Solander, sp.

*Spongia coronata*, Ellis and Solander. Zoophytes, p. 190.

*Grantia ciliata*, auctorum.

*Sycandra coronata*, Hæckel. Die Kalkschwämme, Vol. II, p. 304.

*Locality*.—East coast of Australia (Hæckel. Also recorded from the Mediterranean, Atlantic and Pacific).

5. *Sycon carteri*, n. sp.

Colonial; consisting of very many small *Sycon* individuals united in a copiously branching, bushy mass; branching irregular. *Sycon* individuals about 5 mm. in length by 1.5 mm. in diameter; cylindrical; with minutely conulose surface and naked, terminal oscula.

Canal-system typical; chambers thimble-shaped, rather short, with freely projecting distal cones.

Skeleton arranged in typical manner. Spicules as follows:—(1) Gastral quadriradiates; sagittal; oral rays shorter and stouter than basal, slightly recurved, gradually sharp-pointed, measuring  $0.11 \times 0.007$  mm.; basal ray rather more slender, straight, very gradually sharp-pointed, about 0.2 mm. long; apical ray variable, stout, more or less curved, often angulate, gradually sharp-pointed, about 0.077 mm. long. (2) Gastral triradiates; like the quadriradiates but without the apical ray. (3) Subgastral sagittal triradiates; oral rays extended almost in a line, gradually sharp-pointed, measuring about  $0.06 \times 0.007$  mm.; basal ray very long (0.175 mm.), straight, gradually sharp-pointed, extending for more than half the length of the chamber and forming by itself about half of the articulate tubar skeleton. (4) Ordinary tubar triradiates; like the last but with shorter basal ray and oral angle diminishing towards the distal cone. (5) Oxea of the distal cones; rather short and stout, angulate, with shorter and stouter outer, and longer and slenderer inner segments; fairly sharp-pointed at both ends; measuring about  $0.15 \times 0.01$  mm.

*Locality*.—St. Vincent's Gulf, S. Australia, (coll. Adelaide Museum).

6. *Sycon minutum*, n. sp.

Solitary; sessile, or with very short stalk; sub-cylindrical or sausage-shaped, with naked terminal osculum surrounded by a membranous extension of the wall of the gastral cavity. Texture characteristically soft and spongy; surface minutely conulose. Usually only about 5 or 6 mm. in height by 2 mm. in breadth.

Canal system typical; chambers rather short, thimble-shaped, often octagonal in transverse section, with low rounded distal cones; inhalant canals usually square in transverse section.

Skeleton arranged as usual. Spicules as follows:— (1) Gastral quadriradiates; facial rays straight, subequal in length, very long, slender and gradually sharp-pointed, measuring about 0·12 by 0·0035 mm.; oral angle somewhat smaller than the paired angles; apical ray short, relatively stout, slightly curved, sharp-pointed, about 0·03 mm. long. Towards the osculum these spicules become much more markedly sagittal. (2) Gastral triradiates; like the foregoing, but without apical ray. (3) Subgastral triradiates, not distinguishable in form from the ordinary tubar spicules. (4) Tubar triradiates; varying from sagittal, with very widely extended, slightly curved, oral rays, to sub-regular; rays long and slender, gradually sharp-pointed, the basal not much longer than the orals, measuring about 0·1 by 0·006 mm.; these spicules are rather irregularly arranged. (5) Oxea of the distal cones; not very numerous; long, slender, straight or very slightly curved; fusiform and gradually sharp-pointed at each end; measuring about 0·28 by 0·007 mm.; arranged in loose tufts which project obliquely upwards from the distal cones towards the osculum.

*Locality*.—Watson's Bay, Pt. Jackson (coll. T. Whitelegge).

7. *Sycon raphanus*, O. Schmidt.

*Sycon raphanus*, O. Schmidt. Spong. Adriat. Meer., p. 14.

Abundant in the collection. Solitary, usually about half an inch in height, with well developed stalk, markedly conulose surface and small oscular fringe. In spiculation I can find no tangible distinction between this common Victorian species and the European *S. raphanus* as described by Hæckel in "Die Kalkschwämme."

*Localities.*—Near Port Phillip Heads (Stations 1, 8, 14, and outside the Heads, coll. J. B. Wilson); King Island (coll. Professor Spencer). Hæckel also records the species from Bass Straits and the Gulf of St. Vincent.

8. *Sycon setosum*, O. Schmidt.

*Sycon setosum*, O. Schmidt. Spong. Adriat. Meer., p. 15.

I identify two specimens in the collection with this species. They differ from the typical *S. raphanus* in the more hairy surface, due to the greater length of the dermal oxea, and also in the elongation of the apical rays of the gastral quadriradiates. Probably it is merely a slight variety of *S. raphanus*. The species has hitherto only been recorded from the Mediterranean.

*Locality.*—Near Port Phillip Heads (Stations 6, 9, coll. J. B. Wilson).

9. *Sycon ensiferum*, n. sp.

Solitary, stipitate, closely resembling *S. raphanus*; with very markedly conulose surface and little or no oscular fringe. The two specimens are rather larger and especially stouter than most Australian specimens of *S. raphanus* which I have seen.

Canal-system typical; chambers of good length, terminating in low, rounded distal cones.

Skeleton arranged in typical manner. The species is distinguished by the following characters in its spiculation, which in general characters resembles that of *S. raphanus* closely:—(1) The apical rays of the gastral quadriradiates are very strongly developed, swelling out into long club-shaped form (sword-shaped in longitudinal section), but fairly sharply pointed and only very slightly curved, very much broader in the distal than in the proximal half. (2) The ordinary tubar radiates very frequently have a small apical ray developed. (3) The basal rays of many of the most distally situated tubar triradiates are very strongly bent outwards from the wall of the chamber, so as to curve over and protect the entrances to the inhalant canals. (4) The oxea at the distal ends of the chambers are of moderate length and thickness, straight or nearly so, symmetrical and fairly gradually sharp-pointed at each end.

*Locality.*—Near Port Phillip Heads (Station 9, coll. J. B. Wilson.)

10. *Sycon subhispidum*, Carter, sp.

*Grantia subhispidum*, Carter. Annals and Magazine of National History, July 1886, p. 36.

This species, described by Mr. Carter from Mr. Wilson's collection, evidently belongs to the genus *Sycon*, but I have not been able to identify any of my specimens therewith.

*Locality*.—Near Port Phillip Heads (Carter).

11. *Sycon ramsayi*, von Lendenfeld, sp.

*Sycandra ramsayi*, von Lendenfeld. Proc. Linn. Soc., N.S.W., Vol. IX, p. 1097.

I have only seen specimens of this species from Port Jackson. Mr. Carter, however, records it amongst Mr. Wilson's sponges from Port Phillip. The gastral cavity is, according to my experience, widely dilated, and not comparatively small, as stated in the original description.

*Localities*.—Port Jackson (von Lendenfeld, &c.); near Port Phillip Heads (Carter).

12. *Sycon boomerang*,\* n. sp.

Solitary, stipitate; of slightly compressed, ovoid shape, tapering gradually below to form the narrow stalk, which is about equal in length to the main body of the sponge; with a rather small, terminal, naked osculum. Total height of the specimen about 37 mm., greatest breadth 12.5 mm. The dermal surface is smooth and even, but with a characteristic porous appearance. The wall of the sponge is very thick and the gastral cavity correspondingly narrow.

The radial chambers are very long and narrow and branch repeatedly, the branches running parallel and becoming much narrower as they approach the dermal surface. The inhalant canals are correspondingly long and narrow, and their outer ends are covered over by a delicate pore-bearing membrane which stretches between the rounded distal ends of the chambers. The gastral cortex is thin. The skeleton is arranged in typical manner, the spiculation being as follows:—(1) Gastral quadriradiates; sagittal; with very long, slender, hastate basal ray, measuring about  $0.2 \times 0.007$  mm., sometimes longer; paired rays about one-third to one-half the length of the basal ray and somewhat stouter, straight, conical, gradually sharp-

\* So called from the shape of the apical rays of the gastral quadriradiates.

pointed; apical ray very strongly developed, gradually thickening for about two-thirds of its length, where it is extraordinarily stout, then bending sharply and tapering more suddenly to a sharp point, length about 0.155 mm., greatest thickness up to 0.028 mm. though generally less. (2) Gastral triradiates; sagittal or sub-regular, with long, slender, gradually sharp-pointed rays, the oral rays often somewhat curved. (3) Subgastral sagittal triradiates, not clearly differentiated from the ordinary tubar spicules. (4) Tubar triradiates; with very long, straight, slender, conical basal ray and shorter, widely extended, often slightly curved oral rays. In spicules taken from about the middle of the length of the chamber the basal ray measures about 0.17 by 0.07 mm., and the orals about 0.1 by 0.07 mm.; but there is a good deal of variation. In some of the tubar spicules a fairly well developed apical ray is found. In some of the most distal triradiates the basal ray, now much shortened, is curved outwards so as to lie in the pore-bearing membrane, which is also supported by small, scattered triradiates and oxeotes like those found at the distal ends of the chambers. (5) Oxea of the distal cones; short but fairly stout, more or less club-shaped, usually with the thick distal portion bent at an angle to the remainder; measuring about 0.08 by 0.008 mm.; these characteristic little spicules are arranged in dense tufts at the distal ends of the chambers.

*Locality.*—Near Port Phillip Heads (coll. J. B. Wilson).

13. *Sycon gelatinosum*, Blainville, sp.

*Alcyoncellum gelatinosum*, Blainville. Actinologie, p. 529.

*Syandra alcyoncellum*, Hæckel. Die Kalkschwämme. Vol. 2, p. 333.

*Syandra arborea*, Hæckel. Die Kalkschwämme, Vol. 2, p. 331.

This common Australian species is very variable in form, being either colonial (generally richly branched) or solitary, with the oscula sometimes naked and sometimes provided with a fringe of spicules. The shape of the dermal oxea also varies greatly, from club- or nail-shaped to sharply-pointed at each end. The extensive series of specimens in my collection, from various parts of Australia, shows that it is quite impossible to separate Hæckel's two species, *arborea* and *alcyoncellum*, from one another, and I revert to Blainville's original name, *gelatinosum*, for both.

*Localities.*—Port Jackson; Port Phillip; Bass Straits; St. Vincent's Gulf; west coast of Australia (various authors and collections; Hæckel also records the species from Java).

13A. *Sycon gelatinosum* var. *whiteleggi*, nov.

I propose to distinguish by the above name a very beautiful variety of the foregoing species found by Mr. T. Whitelegge at Watson's Bay, Port Jackson. There are nine specimens, all solitary and with a well-developed oscular fringe of long silky spicules. In addition to this oscular fringe, however, all have a beautiful frill or collar of long, silky spicules, projecting like a halo from the base of the oscular fringe and at right angles to the long axis of the sponge. In external form this variety closely resembles Hæckel's beautiful figure of *S. (Sycarium) elegans*. The dermal oxea are long and slender, and gradually sharp-pointed at each end, and the more distal tubar triradiates are greatly enlarged, with long and stout, but still straight basal rays. These peculiarities in spiculation are, however, found in some specimens of *S. gelatinosum*, from which the present variety cannot be sharply distinguished.

*Locality.*—Watson's Bay, Port Jackson (coll. T. Whitelegge).

14. *Sycon giganteum*, n. sp.

Solitary, with very short stalk or none at all. Tubular, greatly elongated, in parts more or less compressed, but not varying greatly in diameter throughout; with a single, wide, naked osculum. Both specimens are curved or bent. The largest is nearly 100 mm. in length by 14 mm. in breadth; the other is only a little shorter. The wall of the sponge is about 3 mm. in thickness. The dermal surface is in part quite smooth and in part tessellated.

The radial chambers are narrow and greatly elongated, they branch repeatedly and the branches run parallel with one another to the dermal surface. They communicate with the gastral cavity by long exhalant canals, from which they are separated by diaphragms. These exhalant canals appear like continuations of the chambers only without collared cells, they may unite together before opening on the gastral surface. The chambers are approximately circular in transverse section. The inhalant canals are irregular and very



narrow, opening on the dermal surface through narrow, irregular chinks between the tufts of oxea.

The skeleton is arranged as usual, the spiculation being as follows:—(1) Gastral quadriradiates; small, very irregularly and confusedly arranged, so as to form a dense though not very thick cortex; usually more or less strongly sagittal, but very variable in the proportions of the rays. The basal ray varies from two or three times the length of the orals to about the same length or even shorter; it is straight and conical. The oral rays are usually slightly curved towards one another, conical and sharp-pointed, averaging about 0.04 by 0.005 mm. at the base; apical ray conical, very slightly curved, sharply pointed, about 0.05 mm. long. (2) Subgastral sagittal spicules, indistinguishable. (3) Tubar triradiates, with rather short and stout, conical, sharp-pointed rays; the oral rays very widely extended, often nearly at right angles to the basal, nearly straight, averaging about 0.084 mm. by 0.009 mm. at the base; basal ray varying from about the same length to considerably longer than the orals, the disproportion being greatest at the distal ends of the chambers. (4) Tubar quadriradiates, differing from the foregoing in the development of a short, stout, curved and sharply pointed apical ray; abundant, especially towards the gastral surface, where the tubar skeleton becomes very irregular. (5) Oxea, short, straight or rather crooked, slender, tapering to a sharp point at the proximal end and with the distal end swollen out into an ovoid head, like that of a spermatozoon, length about 0.17, thickness below the head 0.007 mm., head nearly twice as thick. These spicules are arranged in very dense tufts at the distal ends of the chambers and their thickened ends form an almost continuous crust over the dermal surface of the sponge. The whole skeleton is very dense and compact, so that the texture of the sponge is very firm, as in *S. gelatinosum*, which it closely approaches in spiculation.

*Locality*.—St. Vincent's Gulf (coll. Adelaide Museum).

15. *Sycon compressum*, auctorum.

*Grantia compressa*, various authors (*e.g.*, Bowerbank).

*Sycandra compressa*, Hæckel. Die Kalkschwämme, Vol. II, p. 360.

This common European species is recorded from Australia both by von Lendenfeld and Carter, but I have never

myself seen specimens from Australian seas. Von Lendenfeld\* states that all the specimens in Australian waters are cylindrical and must be referred to Hæckel's variety *lobata*, which he proposes to erect into a species under the name *Grantia lobata*. Carter† simply records *Grantia compressa* amongst Mr. Wilson's sponges, and also a tubular variety which he terms *fistulata*, and which is probably identical with von Lendenfeld's *lobata*.

I include the species in the genus *Sycon* on account of the tufts of oxea which crown the radial tubes. The dermal cortex is very thin.

*Localities*.—Port Jackson (von Lendenfeld); near Port Phillip Heads (Carter).

#### 16. *Grantia labyrinthica*, Carter.

*Teichonella labyrinthica*, Carter. Annals and Magazine of Natural History, July 1878, p. 37.

*Grantia labyrinthica*, Carter. Annals and Magazine of Natural History, July 1886, p. 38.

I have already given a detailed account of the history and anatomy of this remarkable species in my memoir "On the Anatomy of *Grantia labyrinthica*, Carter, and the so-called Family Teichonidæ," published in Vol. XXXII, N.S., of the Quarterly Journal of Microscopical Science. The species appears to be fairly common near Port Phillip Heads, the largest specimens which I have seen measure no less than five inches across the top, a truly gigantic size for a single *Sycon* individual.

*Localities*.—Fremantle, W.A. (Carter); near Port Phillip Heads (Station 5 and outside the Heads, Carter and coll. J. B. Wilson).

#### 17. *Grantia extusarticulata*, Carter, sp.

*Hypograntia extusarticulata*, Carter. Annals and Magazine of Natural History, July 1886, p. 43.

Solitary, sessile, sac-shaped, broadest below and tapering gradually to the terminal osculum, which is naked. The single specimen is markedly compressed, and measures 25 mm. in height and 11 mm. in greatest width. The wall of the sac is not much more than 1 mm. in thickness and the gastral cavity is correspondingly spacious. The dermal

\* Proc. Linn. Soc., N.S.W. Vol. IX, p. 1106.

† Ann. and Mag. Nat. Hist. July 1886, p. 37.

surface is very smooth. The anatomy is very typical. The radial chambers are straight, cylindrical and only slightly branched, and extend from gastral to dermal cortex. The inhalant pores are irregularly scattered through the dermal cortex, which is well developed and about 0·07 mm. thick. The gastral cortex is of about the same thickness and is perforated by the short, wide exhalant canals, one coming from each chamber and separated from it by a constricted diaphragm.

The skeleton is arranged in typical manner, the spiculation being as follows:—(1) Gastral quadriradiates; sagittal, oral angle a little wider than the laterals; facial rays straight, conical, gradually sharp-pointed; basal ray about 0·2 by 0·01 mm.; oral rays 0·12 by 0·01 mm.; apical ray short, fairly stout, only moderately sharply-pointed, slightly curved, about 0·06 mm. long. (2) Gastral triradiates; similar to the foregoing, but with no apical ray. (3) Subgastral sagittal triradiates; strongly developed, with widely extended, slightly recurved, gradually sharp-pointed oral rays and very long, straight basal ray gradually tapering to a sharp point; oral rays about 0·15 by 0·014 mm.; basal ray about 0·35 by 0·014 mm. (4) Tubar triradiates; somewhat smaller than the foregoing but well developed, with straight or nearly straight rays, gradually sharp-pointed, the basal considerably longer than the other two. (5) Dermal triradiates; sagittal, very similar to the tubar triradiates but perhaps a little longer and placed horizontally in the dermal cortex. (6) Oxea of the dermal cortex; very small, straight, gradually sharp-pointed at the inner end and beautifully hastate or lance-pointed at the outer; about 0·045 by 0·005 mm.; arranged at right angles to the dermal surface. Occasionally a large oxcote spicule is found around the margin of the osculum, but these are extremely rare.

Mr. Carter's specimen, described from Mr. Wilson's collection, was "agglomerated." I have little doubt as to the specific identity of the two, but there are sufficient points of distinction between my specimen and Mr. Carter's original description to render a fresh description desirable.

*Locality.*—Near Pt. Phillip Heads (Carter; and Station 9, coll. J. B. Wilson).

18. *Grantia gracilis*, von Lendenfeld, sp.

*Vosmaeria gracilis*, von Lendenfeld. Proceedings of the Linnean Society of New South Wales, Vol. IX, p. 1111.

In canal system, so far as we can judge from the author's description, this species appears to resemble my *Grantia vosmaeri*, the radial chambers communicating with the gastral cavity by elongated exhalant canals.

*Locality.*—Port Jackson (von Lendenfeld).

19. *Grantia vosmaeri*, n. sp.

Specimen solitary, sessile (?), sac-shaped, tapering gradually above to the naked, terminal osculum; 15 mm. high and 7 mm. in greatest transverse diameter. Texture hard, dermal surface echinated by the large, projecting oxea. Wall of sac only about 1 mm. thick.

The dermal cortex is very strongly developed, about 0.08 mm. thick; the gastral cortex is two or three times as thick, but less dense and not so well-defined. The radial chambers are rather short and more or less branched. Their distal ends abut against the dermal cortex, while proximally they communicate with the gastral cavity by means of long, wide, exhalant canals, which penetrate the gastral cortex and may unite together before opening onto the gastral surface. The chambers are separated from the exhalant canals by constricted diaphragms. The inhalant pores take the form of irregular canals penetrating the dermal cortex.

Except for the unusual thickness of the cortex and the great size of the oxeote spicules the skeleton is arranged in the ordinary manner. The spiculation is as follows:— (1) Gastral quadriradiates; usually more or less sagittal, but very variable; rays straight or paired rays slightly curved, stout, conical and gradually sharp-pointed; size very variable; paired rays averaging, say, about 0.2 by 0.025 mm.; basal ray about the same thickness and usually somewhat longer; apical ray thorn-like, short, stout, conical, usually slightly curved, finely pointed, about 0.07 mm. long, projecting into the gastral cavity and exhalant canals. (2) Gastral triradiates; usually like the foregoing but without the apical ray; towards the osculum, however, they become much more strongly and regularly sagittal, the widespread, slightly recurved oral rays being much longer and stouter than the basal ray; amongst these suboscular spicules quadriradiates are very rare. (3) Subgastral sagittal triradiates; indistinguishable from the remainder of the tubar skeleton, which merges somewhat gradually into the gastral cortex. (4) Tubar triradiates;

strongly sagittal; with widely extended, short, straight, conical and gradually sharp-pointed oral rays, and much longer, straight, gradually sharp-pointed basal ray; oral rays about 0.1 by 0.015 mm.; basal ray about 0.28 by 0.015 mm. (5) Triradiates of the dermal cortex; usually slightly sagittal but nearly regular; rays stout, straight or slightly curved, conical, gradually sharp-pointed; about 0.24 by 0.028 mm.; arranged in several layers parallel with the dermal surface. (6) Oxea; very large, stout, fusiform, usually gently curved, gradually sharp-pointed at each end; varying in size up to about 1.8 by 0.07 mm. The outer ends of these spicules project far beyond the dermal surface, while their inner ends extend through the chamber layer into the gastral cortex.

*Locality.*—Watson's Bay, Port Jackson (coll. T. Whitelegge).

20. *Grantia* (?) *infrequens*, Carter, sp.

*Hypograntia infrequens*, Carter. Annals and Magazine of Natural History, July 1886, p. 39.

The chief peculiarities of this species appear to be the presence of a very strong dermal cortex and the fact that the tubar skeleton is made up entirely of the basal rays of subgastral sagittal triradiates. I have not seen the species myself, and Mr. Carter apparently had only a single small specimen, collected by Mr. Wilson. I include it provisionally in the genus *Grantia*.

*Locality.*—Near Port Phillip Heads (Carter).

21. *Grantia* (?) *lævigata*, Hæckel, sp.

*Sycortis lævigata*, Hæckel. Die Kalkschwämme, Vol. II, p. 285.

In his description Hæckel distinctly states that in the case of the tubar triradiates the basal ray is always directed centrifugally outwards, while in the dermal triradiates it lies parallel to the long axis of the sponge and points to the aboral pole. No mention is made in the text of any subdermal sagittal triradiates with inwardly directed basal ray, but in the figure (Plate 49, Fig. 3) such appear to be present. Hence if the figure be correct we should have to place the species in the genus *Grantessa*, but the evidence is hardly strong enough to justify us in so doing at present.

*Locality.*—Gulf of St. Vincent (Hæckel).

22. *Grantiopsis cylindrica*, n. sp.

Sponge forming long, cylindrical tubes, which may branch, with single, terminal, slightly constricted, almost naked oscula. Surface not hispid but slightly roughened by the large triradiate spicules of the cortex. The largest tube in the collection is unbranched and slightly crooked, 57 mm. long and with a nearly uniform diameter of 5 mm.

The wall of the tube is about 1 mm. in thickness, and is divided into two sharply defined concentric layers of about equal thickness. The outer of these layers forms a firm cortex with a very strongly developed skeleton. The inner layer is soft and spongy, consisting almost entirely of the radial chambers, which have but a feebly developed tubar skeleton.

The inhalant pores, scattered in groups over the dermal surface, lead into very sharply defined, wide inhalant canals, which penetrate the cortex, uniting into larger trunks which conduct the water to the ordinary "intercanals" between the radial chambers.

The radial chambers are arranged side by side with great regularity. Each is a straight, wide, unbranched (or very slightly branched) tube, extending completely through the chamber layer. In cross section they vary from nearly square to nearly circular. Each opens directly and separately into the gastral cavity, the gastral cortex being so thin that no special exhalant canals are required. Each is provided at its proximal end with a membranous diaphragm, which, in the spirit specimen, almost closes the opening.

The arrangement of the skeleton is a slight modification of the *Grantia* type, but the spiculation is very peculiar, as follows:—(1) Gastral quadriradiates; slightly sagittal, with small facial and enormous apical rays; the oral angle is rather wider than the lateral angles, but there is not much difference in the length of the facial rays, which are nearly straight (the orals may be slightly curved), fairly stout, conical and gradually sharp-pointed, about 0·056 by 0·007 mm. The apical ray is slightly curved, very stout, sword-shaped in optical section, thickest in about the middle, gradually sharp-pointed, about 0·14 by 0·014 mm. These apical rays thickly echinate the gastral surface. (2) Subgastral quadriradiates; strongly sagittal; the oral rays very widely extended and parallel to the gastral surface; the basal ray extending centrifugally towards the dermal surface through

about half the thickness of the chamber layer; the apical ray projecting into the gastral cavity, almost in a line with the basal ray. The basal ray is long, straight, and gradually sharp-pointed, about 0.28 by 0.01 mm.; the oral rays are short, straight, conical and gradually sharp-pointed, about 0.056 by 0.008 mm.; the apical ray is slender, conical, elongated, slightly curved and finely pointed, about 0.09 by 0.007 mm. (3) Tubar triradiates; consisting almost entirely of the strongly developed, centrifugally directed basal ray, which is straight, fusiform, gradually sharp-pointed at the distal end, and at the proximal end provided with a pair of minute, widely divergent, conical teeth, which represent the extremely reduced oral rays. The basal ray measures about 0.3 by 0.068 mm., while the teeth representing the oral rays are only about 0.003 mm. in length. The entire tubar skeleton is made up of these spicules and the basal rays of the subgastral quadriradiates, arranged usually in single series but with overlapping ends, each series comprising only about three spicules. (4) Triradiates of the dermal cortex; very large and stout and regularly sagittal, the oral angle being very considerably wider than the paired angles; all the rays are straight, conical and gradually sharp-pointed, the oral rays measuring about 0.54 by 0.07 mm., and the basal ray somewhat shorter and slenderer. These spicules are arranged in many layers, parallel to the dermal surface and extending through the entire thickness of the cortex. (5) Dermal oxea; short, slender, slightly crooked, sharply pointed at each end, about 0.1 by 0.006 mm. These spicules occur in large numbers on the dermal surface, projecting at right angles from the outermost portion of the cortex. (6) Oxea of the oscular fringe; long, straight and slender, gradually sharp-pointed at each end though hastate at the outer end. These spicules form a kind of vertical palisade inside the margin of the osculum, their outer ends projecting to form a feebly developed oscular fringe. (7) Ocular triradiates: closely resembling the remarkable tubar triradiates, but with the oral rays not quite so much reduced. These spicules occur mixed with the inserted portions of the oscular oxea, and assist the latter in forming a dense palisade; the paired rays are directed towards the osculum, and no part of the spicule projects freely like the oxea do.

This sponge is decidedly the gem of Mr. Wilson's collection. The exquisite symmetry of the skeleton and canal-system, combined with the remarkable spiculation, render it one of

the most beautiful and interesting sponges which I have ever seen, although the external form is not particularly attractive.

*Locality.*—Near Port Phillip Heads (coll. J. B. Wilson).

23. *Ute syconoides*, Carter, sp.

*Aphroceras syconoides*, Carter. *Annals and Magazine of Natural History*, August 1886, p. 135.

I identify with this species a single specimen collected by Mr. Wilson and a number of very beautiful examples sent to me from Port Jackson by Mr. T. Whitelegge. As pointed out by Mr. Carter, the species closely resembles Schmidt's *Ute glabra*, having the same characteristic silvery sheen on the surface, due to the presence of the huge, longitudinally disposed oxea. The Port Jackson specimens are shortly stipitate and one of them consists of two individuals united below for about half their length, or one might regard it as a branched individual.

*Localities.*—Near Port Phillip Heads (Carter, and Station 14, coll. J. B. Wilson); Watson's Bay, Port Jackson (coll. T. Whitelegge).

24. *Ute argentea*, Poléjaeff.

*Ute argentea*, Poléjaeff. Report on the Calcareous of the Challenger Expedition, p. 43.

This species is also very similar to Schmidt's *Ute glabra*. Although the skeleton is, as Poléjaeff points out, "inarticulate," there are no subdermal sagittal triradiates with inwardly directed basal ray. From personal examination of Poléjaeff's type I believe this species to be quite distinct from *Ute syconoides*, the latter differing, amongst other things, in its much longer radial chambers, with many-jointed tubar skeleton, and in the much slenderer and less densely packed longitudinal oxea.

*Locality.*—Off Twofold Bay (Poléjaeff).

25. *Ute spiculosa*, n. sp.

Sponge colonial, consisting of a number of individuals (about twenty in the specimen under examination) united together by their bases so as to form a spreading colony. The individuals composing the colony are sessile, ovoid, narrowing above to the small terminal osculum, which has



a very inconspicuous fringe; they attain a height of about 15 mm. and a maximum diameter of about 5 mm. The texture is dense and firm, and the surface is roughened by the projecting ends of some of the large oxea.

The gastral cavity is narrow and cylindrical, occupying only about one-third of the total diameter of the sponge. The flagellated chambers are long and narrow and more or less radially arranged with regard to the central gastral cavity; they do not extend nearly through the entire thickness of the sponge wall, and they communicate with the gastral cavity through long, sometimes branched exhalant canals. The inhalant canal system consists of scattered pores on the dermal surface leading into elongated canals which lead down between the chambers, but the typical syconoid arrangement of the canal system is greatly obscured by the strong development of the mesoderm and the dense, irregular skeleton. There is a very thick, dense cortex on both dermal and gastral surfaces.

The skeleton of the gastral cortex consists of a densely felted mass of irregularly arranged triradiates, mostly lying parallel to the gastral surface. These spicules are sagittal, with fairly stout, straight, conical and gradually sharp-pointed rays; the oral rays are longer than the basal and the oral angle wider than the other two; oral rays about 0.18 mm. by 0.02 mm., basal about 0.12 mm. by 0.016 mm. The skeleton of the chamber layer is dense and irregular, but shows traces of the articulate tubar arrangement in the usually centrifugal direction of the basal rays of the triradiates. These spicules are smaller than those of the gastral cortex, and of different shape; there is not much difference in the length of the rays, though the basal may be slightly longer or shorter than the others; all the rays are fairly stout, conical and gradually sharp-pointed; the basal is straight but the orals are more or less curved towards one another; dimensions of rays about 0.12 by 0.016 mm.

The skeleton of the dermal cortex consists of a dense, confused mass of triradiates, resembling those of the chamber layer but becoming markedly smaller towards the outside, where they lie parallel to the surface; amongst which are found oxea of two kinds:—(1) Very large, stout, fusiform, slightly curved and sharply pointed at each end; measuring about 1.8 mm. by 0.1 mm., and arranged parallel to the long axis of the sponge, with the upper end often

slightly projecting. (2) Small, long and slender, nearly straight, gradually sharp-pointed at the inner end and usually more or less hastate or lance-pointed at the outer; measuring about 0·24 by 0·008 mm. These spicules occur in the outermost portion of the cortex, and their outer ends project well beyond and more or less at right angles to the dermal surface. A number of similar but longer spicules inserted around the inside of the osculum form a dense but not prominent oscular fringe.

*Locality*.—Watson's Bay, Pt. Jackson (coll. T. Whitelegge).

26. *Ute spenceri*, n. sp.

Sponge solitary, sessile, globular or sub-spherical, with correspondingly dilated gastral cavity and narrow, naked osculum. The texture is firm and harsh to the touch, the dermal surface being rather uneven and slightly roughened by the projecting apices of some of the large oxea, but not hispid. Diameter of entire sponge about 11 mm.; thickness of wall about 2·5 mm. The dermal cortex is very thick, occupying more than one-third of the entire thickness of the wall.

The inhalant pores, scattered over the surface of the sponge, lead into wide, irregular, sub-dermal cavities, lying in the cortex, from which narrow inhalant canals lead down between the radial chambers. The radial chambers are arranged with considerable regularity parallel to one another. They are long and narrow (about 1·0 mm. by 0·14 mm.), and at their distal ends they branch in a curiously irregular manner, the branches sometimes penetrating for some little distance into the dermal cortex. The proximal ends of the chambers are all situate about at the same level, which is some little distance from the gastral cavity and even from the gastral cortex, which latter, though dense, is very thin as compared with the dermal cortex. Hence we find a number of rather short, cylindrical, radially-arranged exhalant canals, which look like continuations of the radial chambers without the collared cells, and which may unite together in groups before opening on the gastral surface. The radial chambers are separated from the exhalant canals by well-marked diaphragms.

The skeleton is very dense and very complicated and consists of the following parts:—(1) Quadriradiates of the gastral cortex; sagittal, with straight, conical, gradually sharp-pointed facial rays; the oral angle is wider than the

paired angles and the basal ray may be either longer or shorter than the other two, which measure, say, about 0.09 by 0.008 mm.; the apical ray is well developed, conical, gradually sharp-pointed, slightly curved, and nearly as long and thick as the oral rays. These spicules form such a dense feltwork that it is difficult to make out the details of individual form *in situ*, while the projecting apical rays thickly echinate the gastral cavity. (2) Quadriradiates of the exhalant canals; these are extremely characteristic and peculiar spicules; the basal ray is reduced to a mere rounded tubercle, while the oral and apical rays are long, straight and very slender, and finely pointed; the oral rays diverge at an angle of about 120° and the apical comes off between them and appears to lie nearly in the same plane; the oral rays measure about 0.08 by 0.0027 mm., though occasionally stouter, and the apical ray is about one-third as long; these spicules are found around the exhalant canals, with the apical ray projecting into the cavity. A few larger and stouter quadriradiates, with normal basal ray, also occur around the exhalant canals. (3) Inner sagittal triradiates; under this term we may perhaps, in this species, include all those triradiates which lie in the zone between the gastral cortex and the commencement of the flagellated chambers, although they lie at varying depths beneath the gastral cortex. The oral rays are straight or nearly so, conical and gradually sharp-pointed, about 0.09 by 0.0085 mm.; the basal ray is long, straight, conical and gradually sharp-pointed, measuring about 0.16 by 0.0085 mm.; the oral angle is wider than the paired angles. (4) Tubar triradiates; very similar to the foregoing but the basal ray gradually diminishes in length towards the dermal cortex. These spicules form an articulate tubar skeleton of many joints, which is continued, as already indicated, within the inner limits of the chamber layer to the gastral cortex, while towards the outside it becomes irregular and gradually passes into the skeleton of the dermal cortex. (5) Triradiates of the dermal cortex; slightly sagittal or sub-regular, mostly larger and stouter than the tubar triradiates, with conical, sharp-pointed rays measuring about 0.16 by 0.02 mm., but very variable; towards the outside they lie parallel to the dermal surface, but otherwise they are very irregularly arranged. (6) Large oxea of the dermal cortex; fusiform, slightly curved, gradually sharp-pointed at each end; measuring about 1.4 by 0.1 mm., but sometimes more or

less. These spicules are imbedded in large numbers in the dermal cortex at various levels; they mostly lie more or less parallel to the long axis of the sponge, but there is a good deal of irregularity in their arrangement and not infrequently one end of the spicule projects slightly beyond the dermal surface. (7) Minute oxea of the dermal surface; short and slender, usually slightly curved; the inner end gradually tapering to a fine point, the outer end thicker, more or less hastate, minutely toothed or roughened. These spicules measure only about 0·04 by 0·003 mm.; they occur in large numbers on the dermal surface. (8) Minute oxea of the gastral surface; similar to the foregoing but not so numerous.

One of the two specimens in the collection was attached to a crab's back, which it completely covered like a thick crust; it resembled a specimen cut in half longitudinally, with the concave gastral surface turned towards the crab's back. Hence, as the gastral cavity was no longer an enclosed space, there was no osculum in the ordinary sense of the word. The crab, of course, occupied the gastral cavity, and the exhalant canals of the flagellated chambers must have discharged their contents on to the crab's back. One often finds sponges growing on crab's backs, but I never before saw a case in which the essential form of the sponge was so strangely modified in accordance with this habit. Had it not been for the presence of the other and normal specimen in the collection I should have been inclined to regard this strange modification in form as of at least specific value. The species, is, however, so well characterised by spiculation, &c., that there can be no doubt as to the identity of the two specimens.

I have much pleasure in dedicating this remarkable species to Professor W. Baldwin Spencer.

*Locality.*—Watson's Bay, Port Jackson (coll. T. Whitelegge).

### 27. *Synute pulchella*, Dendy.

*Synute pulchella*, Dendy. *Proceedings of the Royal Society of Victoria*, Vol. IV (New Series), p. 1.

I have nothing to add to my description of this remarkable sponge until such time as I may be able to publish illustrations of its anatomy.

*Locality.*—Near Port Phillip Heads (Dendy).

28. *Anamixilla torresi*, Poléjaeff.

*Anamixilla torresi*, Poléjaeff. Report on the Calcareous of the Challenger Expedition, p. 50.

I have seen no specimen of this sponge except a portion of the type from the British Museum.

*Locality*.—Torres Straits (Poléjaeff).

29. *Leucandra australiensis*, Carter, sp.

*Leuconia fistulosa*, var. *australiensis*, Carter. Annals and Magazine of Natural History, August 1886, p. 127.

There is one specimen in the collection, belonging to the National Museum, which closely resembles in external characters and spiculation that described by Mr. Carter. The slenderness of the radiate spicules gives to the sponge a soft and yielding texture, while the dermal surface is densely hispid from the long, slender, projecting oxea. At first sight the specimen looks like a large example of *Grantessa hirsuta*, but it differs markedly in the arrangement of the canal system and in the absence of the subdermal sagittal triradiates. The chambers are large and irregularly sac-shaped, averaging say about 0.3 by 0.1 mm. (but very variable); not arranged radially around the central gastral cavity of the sponge, but around wide exhalant canals which penetrate the thickness of the wall of the sponge and are, like the gastral cavity itself, echinated by the apical rays of quadri-radiate spicules.

*Locality*.—Near Port Phillip Heads (Carter, and Station 14, coll. J. B. Wilson).

30. *Leucandra alcicornis*, Gray, sp.

*Aphroceras alcicornis*, Gray. Proceedings of the Zoological Society of London, 1858, p. 114.

*Leucandra alcicornis*, Hæckel. Die Kalkschwämme, Vol. II, p. 184.

I have not yet had an opportunity of examining this widely distributed and very remarkable species.

*Locality*.—Bass Straits (Hæckel). Also recorded from various localities in the Pacific and Indian Oceans and from the Cape (*vide* Hæckel).

31. *Leucandra cataphracta*, Hæckel.

*Leucandra cataphracta*, Hæckel. Die Kalkschwämme, Vol. II, p. 203.

*Leucandra cataphracta*, von Lendenfeld. Proceedings of the Linnean Society of New South Wales, Vol. IX, p. 1129.

I am indebted to Mr. T. Whitelegge for a considerable number of fine specimens of this sponge from Watson's Bay, Port Jackson. Neither Hæckel nor von Lendenfeld have described the flagellated chambers, which are small, approximately spherical and scattered abundantly in the thick wall; measuring about 0.09 mm. in diameter.

*Localities.*—Port Jackson (Hæckel, von Lendenfeld, &c.); Port Denison (von Lendenfeld).

32. *Leucandra typica*, Poléjaeff, sp.

*Leuconia typica*, Poléjaeff. Report on the Calcareous of the Challenger Expedition, p. 56.

*Leucandra typica*, von Lendenfeld. Proceeding of the Linnean Society of New South Wales, Vol. IX, p. 1130.

*Locality.*—Port Jackson (von Lendenfeld. Recorded by Poléjaeff from the Bermuda Islands).

33. *Leucandra meandrina*, von Lendenfeld.

*Leucandra meandrina*, von Lendenfeld. Proceedings of the Linnean Society of New South Wales, Vol. IX, p. 1128.

I identify with this species a somewhat massive but not large specimen collected by Mr. Wilson, which seems to agree closely with a fragment of the type from the British Museum, but the species is by no means an easy one to characterise.

The chambers are approximately spherical and about 0.09 mm. in diameter.

*Localities.*—Port Jackson (von Lendenfeld); near Port Phillip Heads (coll. J. B. Wilson).

34. *Leucandra vaginata*, von Lendenfeld.

*Leucandra vaginata*, von Lendenfeld. Proceedings of the Linnean Society of New South Wales, Vol. IX, p. 1133.

*Locality.*—Port Jackson (von Lendenfeld).

35. *Leucandra conica*, von Lendenfeld.

*Leucandra conica*, von Lendenfeld. Proceedings of the Linnean Society of New South Wales, Vol. IX, p. 1126.

*Locality.*—Port Jackson (von Lendenfeld).

36. *Leucandra hispida*, Carter, sp.

*Leuconia hispida*, Carter. Annals and Magazine of Natural History, August 1886, p. 128.

This species is abundant in the collection. It is distinguished by its elongated cylindrical form, hispid surface, and the long-rayed, slender triradiates of the main skeleton. All the specimens are solitary and sessile, of moderate size and with a well-developed oscular fringe. The large oxea of the dermal surface are long and comparatively slender, slightly curved. The flagellated chambers are approximately spherical and average about 0.09 mm. in diameter.

Mr. Carter appears to have had only a single specimen (collected by Mr. Wilson), which was exceptionally short and "conoglobular;" I judge from his description and manuscript illustrations of the spiculation that it is specifically identical with the specimens described above.

*Localities.*—Near Port Phillip Heads (Carter, and Stations 6, 10, 14, coll. J. B. Wilson); Port Jackson (coll. Professor Spencer).

37. *Leucandra echinata*, Carter, sp.

*Leuconia echinata*, Carter. Annals and Magazine of Natural History, August 1886, p. 129.

This species is abundant in the collection. The sponge usually has the form of a rather small, ovoid, sessile, thick-walled individual, with terminal fringed osculum and coarsely echinated dermal surface. The species exhibits a good deal of variation in spiculation, especially in the size of the irregularly arranged triradiates of the main skeleton, which are often very much larger than those of the dermal cortex. The other forms of spicule present are gastral quadriradiates, large dermal oxea (echinating the surface), and long, slender, hair-like oxea of the oscular fringe. The flagellated chambers are approximately spherical and densely scattered throughout the thickness of the wall; they measure about 0.09 mm. in diameter.

*Locality.*—Near Port Phillip Heads (Carter, and Stations 1, 9, 10 and outside the Heads, coll. J. B. Wilson); Watson's Bay, Port Jackson (coll. T. Whitelegge).

38. *Leucandra multifida*, Carter, sp.

*Leuconia multifida*, Carter. Annals and Magazine of Natural History, August 1886, p. 141.

*Locality.*—Near Port Phillip Heads (Carter).

39. *Leucandra lobata*, Carter, sp.

*Leuconia lobata*, Carter. *Annals and Magazine of Natural History*, August 1886, p. 143.

*Locality*.—Near Port Phillip Heads (Carter).

40. *Leucandra compacta*, Carter, sp.

*Leuconia compacta*, Carter. *Annals and Magazine of Natural History*, August 1886, p. 144.

*Locality*.—Near Port Phillip Heads (Carter).

41. *Leucandra phillipensis* n. sp.

The single specimen in the collection is a solitary, sessile, irregularly sac-shaped sponge, with a constricted terminal osculum provided with a feebly developed oscular fringe. The outer surface of the sponge is slightly hispid and the wall of the sponge is rather thin, enclosing a wide gastral cavity. The height of the sponge is about 40 mm., the greatest width 20 mm., and the thickness of the wall nearly 3 mm. There is a very thin dermal and gastral cortex. The canal-system is very typical; thickly scattered groups of dermal pores lead into wide, more or less lacunar inhalant canals, which penetrate deep into the substance of the wall. The exhalant canals are also wide and deep and unite together in groups before opening into the gastral cavity. Between these wide inhalant and exhalant canals the flagellated chambers are thickly scattered; these are generally more or less ovoid in shape but only about 0.14 mm. in longer diameter.

The skeleton is rather weak owing to the prevailing slenderness of the spicule-rays, the spiculation being as follows:—(1) Gastral quadriradiates; usually more or less sagittal; with very long, slender, straight or nearly straight, sharp-pointed facial rays; the oral angle wider than the paired angles and the oral rays somewhat longer than the basal; oral rays about 0.4 by 0.01 mm.; basal ray about 0.3 by 0.01 mm. The apical ray is straight or slightly curved, conical and finely pointed, measuring about 0.16 by 0.01 mm. These spicules are very abundant and form a thin gastral cortex, the apical rays projecting into the gastral cavity in large numbers. The walls of the larger exhalant canals are also provided with very similar spicules. Near the osculum the gastral spicules become much more strongly sagittal and



the apical ray is often absent. (2) Triradiates of the main skeleton; varying from nearly regular to slightly sagittal; with very long, slender, straight or slightly curved rays, sharply pointed and measuring about 0.33 by 0.016 mm. These spicules are very irregularly arranged but many of them have one ray pointing centrifugally towards the dermal surface. In many of them a small apical ray is developed. (3) Triradiates of the dermal surface; similar to the foregoing but decidedly smaller; arranged parallel to the surface to form a thin dermal cortex. (4) Large dermal oxea; rather slender, fusiform, symmetrical, very slightly curved, gradually sharp-pointed at each end; measuring about 1.4 by 0.03 mm.; occasionally however they are much larger and they may then have a hastately pointed inner end. These spicules are scattered singly and irregularly at right angles to the dermal surface, with the outer end projecting for a short distance. (5) Long, fine, hair-like oxea; these are arranged in loose, irregular, scattered bundles between the large oxea and they also form the feebly developed oscular fringe.

*Locality.*—Near Port Phillip Heads (coll. J. B. Wilson).

42. *Leucandra gladiator*, n. sp.

The single specimen in the collection forms an extremely irregular, contorted crust, with a number of deeply convex surfaces, bordered by prominent margins, as if it had grown over some irregularly cylindrical body. A few small oscula are irregularly scattered over the convex upper surface. The surface is slightly hispid, the hispid character becoming much more strongly developed at the margins of the crust. The specimen has been broken, but it must have been about 50 mm. in greatest diameter. The growth has been extremely irregular, and it has enclosed various foreign objects. The texture is coarse and fragile. The dermal cortex is strong, but not very thick.

The canal-system is difficult to work out in detail, owing to the strong development of the skeleton, which renders section-cutting very difficult. There is no large, central, gastral cavity, but a number of tolerably wide exhalant canals converge towards each osculum. The flagellated chambers are irregularly scattered, approximately spherical, and about 0.09 mm. in diameter.

The skeleton is composed of the following spicules:—(1) Gastral quadriradiates; minute, cruciform or dagger-shaped;

the apical ray long, slender, straight and gradually sharp-pointed, nearly in a line with the basal ray; the facial rays short, stout, conical and sharp-pointed, the basal rather longer than the other two and often slightly crooked, the orals being straight; basal ray about 0.03 by 0.007 mm.; orals 0.02 by 0.007 mm.; apical 0.08 (or less) by 0.006 mm. These spicules are found in the walls of the larger exhalant canals, but they are not very abundant. (2) Enormous sub-regular or irregular triradiates, with conical, gradually sharp-pointed rays which measure, when fully developed, about 1.8 by 0.16 mm. These spicules form the bulk of the skeleton and are irregularly and abundantly scattered throughout the thickness of the sponge; they vary considerably in size. (3) Small, straight oxea, of hair-like fineness and up to about 0.1 mm. in length; scattered through the interior of the sponge, either separately or in dense sheaves (trichodragmata). (4) Triradiates of the dermal cortex; strongly sagittal, with long, nearly straight, very widely extended, gradually sharp-pointed oral rays, and much shorter, straight, gradually sharp-pointed basal ray; these spicules form a dense feltwork, they are quite irregularly arranged, except that they all lie parallel to the dermal surface. They vary greatly in size, the oral rays, which are extended almost in a line, measuring up to about 0.65 by 0.036 mm., with the basal about 0.3 by 0.036 mm. (5) Dermal oxea; straight, slender, gradually sharp-pointed at each end. In most parts of the surface these spicules are comparatively few in number, projecting at right angles from the dermal cortex and measuring only about 0.4 by 0.01 mm. They vary greatly in size, however, and around the margins of the sponge they become very greatly elongated, forming a thick, dense fringe.

This very remarkable species is obviously very closely related to the European *Leucandra nivea*, as described by Hæckel in "Die Kalkschwämme"; in both we find colossal triradiates, smaller dermal triradiates, dagger-shaped quadriradiates and trichodragmata (which are extremely rare in calcareous sponges), and in both we meet with the characteristic encrusting habit. There are, however, certain marked differences in spiculation, as in the shape of the dermal triradiates and of the dagger-shaped quadriradiates, and especially in the presence in *L. gladiator* of the projecting dermal oxea, which seem to be entirely wanting in *L. nivea*.

It is important to notice that Mr. Carter's *Leuconia nivea* var. *australiensis* appears to be totally distinct both from the true *Leucandra nivea* and from *L. gladiator*. It is curious that Mr. Carter should have chosen this name for one of Mr. Wilson's sponges and that later on Mr. Wilson should have obtained from the same locality another species which really is very closely related to the remarkable *Leucandra nivea*.

*Locality*.—Outside Port Phillip Heads (coll. J. B. Wilson).

43. *Leucandra carteri*, n. sp.

*Leucaltis floridana*, var. *australiensis*, Carter. Annals and Magazine of Natural History, August 1886. p. 145.

This species appears, from Mr. Carter's description, to be a large, massive *Leucandra*, resembling *L. microraphis* in form but distinguished by the presence of minute oxea on the surface. As the name *australiensis* is already occupied in the genus I propose to call the species *Leucandra carteri*.

*Locality*.—Near Port Phillip Heads (Carter).

44. *Leucandra schulzei*, Poléjaeff, sp.

*Eilhardia schulzei*, Poléjaeff. Report on the Calcareous of the Challenger Expedition, p. 70.

*Localities*.—Off Pt. Jackson and Twofold Bay (Poléjaeff).

45. *Leucandra loricata*, Poléjaeff, sp.

*Leuconia loricata*, Poléjaeff. Report on the Calcareous of the Challenger Expedition, p. 63.

*Leucortis loricata*, von Lendenfeld. Proceedings of the Linnean Society of New South Wales, Vol. IX, p. 1123.

*Locality*.—Off Port Jackson (Poléjaeff).

46. *Leucandra pulvinar*, Hæckel, sp.

*Leucortis pulvinar*, Hæckel. Die Kalkschwämme, Vol. II, p. 162.

This species ranges, according to Hæckel, from the Red Sea to the west coast of Australia. I have not yet met with it.

*Locality*.—West coast of Australia (Hæckel. Also recorded from the Red Sea and various parts of the Indian Ocean).

47. *Leucandra helena*, von Lendenfeld, sp.

*Leucaltis helena*, von Lendenfeld. *Proceedings of the Linnean Society of New South Wales*, Vol. IX, p. 1119.

*Locality*.—Port Jackson (von Lendenfeld).

48. *Leucandra pumila*, Bowerbank, sp.

*Leuconia pumila*, Bowerbank. *Monograph of British Sponges*, Vol. 2, p. 41.

*Leucaltis pumila*, Hæckel. *Die Kalkschwämme*, Vol. 2, p. 148.

*Locality*.—Bass Straits (Hæckel. Also recorded from various localities in the Atlantic Ocean, *vide* Bowerbank and Hæckel).

49. *Leucandra bathybia*, Hæckel, sp.

*Leucaltis bathybia*, Hæckel. *Die Kalkschwämme*, Vol. 2, p. 156.

*Leucaltis bathybia* var. *australiensis*, Ridley. *Zool. Coll. H.M.S. "Alert," British Museum*, p. 482.

*Leucaltis bathybia*, von Lendenfeld. *Proceedings of the Linnean Society of New South Wales*, Vol. IX, p. 1121.

*Locality*.—Port Jackson (Ridley. Recorded by Hæckel from the Red Sea).

50. *Leucandra pandora*, Hæckel, sp.

*Leucetta pandora*, Hæckel. *Die Kalkschwämme*, Vol. 2, p. 127.

*Localities*.—Bass Straits and Gulf of St. Vincent (Hæckel).

51. *Leucandra microraphis*, Hæckel, sp.

*Leucetta microraphis*, Hæckel. *Die Kalkschwämme*, Vol. 2, p. 119 (= *Leucetta primigenia* var. *microraphis*).

*Leucetta microraphis*, von Lendenfeld, *Proceedings of the Linnean Society of New South Wales*, Vol. IX, p. 1117.

*Leuconia dura*, Poléjaeff. *Report on the Calcareous of the Challenger Expedition*, p. 65.

I identify with this species a number of large specimens of very irregular external form. They are sometimes compressed, sometimes massive and sometimes sac-shaped, with thick walls; usually with wide naked oscula and large

exhalant canals. The texture is very coarse, hard and dense; the surface is irregular, and often characteristically ridged; frequently the huge triradiate spicules can be seen with the naked eye on the dermal surface. Some specimens have a few quadriradiate spicules, while in others I cannot find any.

Some of the specimens measure four or five inches in their longest diameter, and one was remarkable from having been of a green colour in life, probably due to symbiotic algae.

The flagellated chambers are approximately spherical; thickly scattered through the sponge, and about 0.12 mm. in diameter. In some specimens the mesoderm around the chambers is very strongly developed, giving to the sponge a very dense texture. The inhalant pores are scattered thickly over the dermal surface, at any rate in parts.

The skeleton is dense and very irregular, consisting of scattered triradiates of two very different sizes, rather small and enormously large, the former being most abundant.

I consider Poléjaeff's *Leuconia dura* to be identical with this species, because I do not think the presence of sagittal spicules in the neighbourhood of the osculum is a specific character, as it is of such extremely general occurrence.

*Localities.*—Near Port Phillip Heads (Stations 1 and 9 and outside the Heads, coll. J. B. Wilson); Torres Straits (Ridley, Poléjaeff); Port Jackson (von Lendenfeld).

52. *Leucandra hækkeliana*, Poléjaeff, sp.

*Leucetta hækkeliana*, Poléjaeff. Report on the Calcareous of the Challenger Expedition, p. 69.

*Vosmaeria hækkeliana*, von Lendenfeld. Proceedings of the Linnean Society of New South Wales, Vol. IX, p. 1114.

*Locality.*—Off Port Jackson (Poléjaeff).

53. *Lelapia australis*, Carter.

(?) *Lelapia australis*, Gray. Proceedings of the Zoological Society of London, 1867, p. 557.

*Lelapia australis*, Carter. Annals and Magazine of Natural History, August 1886, pp. 138 and 148.

This sponge appears to be of exceptional interest, and I greatly regret that I have never had an opportunity of examining it.

*Locality.*—Near Port Phillip Heads (Carter).

54. *Grantessa sacca*, von Lendenfeld.

*Grantessa sacca*, von Lendenfeld. Proceedings of the Linnean Society of New South Wales, Vol. IX, p. 1098.

*Hypograntia sacca*, Carter. Annals and Magazine of Natural History, July 1886, p. 42.

This very beautiful sponge is well represented in the collection. All the specimens which I have seen, six in number, are more or less compressed, in the case of large specimens very much so. The finest specimen is 60 mm. in height by 50 mm. in greatest breadth. Von Lendenfeld represents the radial chambers as being perfectly straight and unbranched, whereas, in the Victorian specimens, they branch repeatedly, the branches running parallel with one another to the dermal surface. This may possibly constitute a specific difference, but I am more inclined to think that the figure referred to is incorrect.

*Localities*.—Port Jackson (von Lendenfeld); near Port Phillip Heads (Carter, and outside the Heads, coll. J. B. Wilson).

55. *Grantessa hirsuta*, Carter, sp.

*Hypograntia hirsuta*, Carter. Annals and Magazine of Natural History, July 1886, p. 41.

In anatomical characters this species closely resembles *G. sacca*, but differs markedly in external appearance and in the less regularly arranged tubar skeleton, which, though composed of slender spicules, is very dense and confused. The subdermal sagittal triradiates, with inwardly directed basal rays, are not mentioned by Mr. Carter; they are clearly present in my specimens though less obvious than in *G. sacca* on account of the somewhat confused character of the tubar skeleton. The oxea of the dermal tufts are straight, or only very slightly curved. The manuscript illustration which Mr. Carter has kindly sent me shows only a very slight curvature, though he describes them as "curved." The species is abundant in the collection.

*Localities*.—Near Port Phillip Heads (Carter; and Station 1 and outside the Heads, coll. J. B. Wilson); King Island (coll. Prof. Spencer); Hobart, Tasmania (coll. A. Dendy).

56. *Grantessa hispida*, n. sp.

Small, cylindrical or slightly compressed, solitary persons, with more or less distinct fringe around the terminal oscu-

lum and strongly hispid surface. The largest specimen in the collection is about 40 mm. high by 4 mm. in greatest diameter, the wall of the sponge being only about 0.56 mm. thick. The canal system closely resembles that of *G. sacca*, but the chambers are shorter and less branched. The skeleton is arranged as in *G. sacca*, but the dermal tufts of oxea are less definite and less regularly arranged, and the tubar skeleton is composed of much fewer joints. The spiculation is as follows:—(1) Gastral quadriradiates; very rare, with short apical ray. (2) Gastral triradiates; strongly sagittal, with very long and slender rays; gradually sharp-pointed; basal ray straight, about 0.3 by 0.0083 mm.; oral rays straight or slightly crooked, often unequal in length, about 0.2 by 0.008 mm. (3) Subgastral sagittal triradiates; oral rays widely extended, slightly recurved, sharply-pointed, about 0.12 by 0.0082 mm.; basal ray long, straight, sharp-pointed, varying in length up to about 0.3 mm., and about as thick as the orals, extended in a centrifugal direction through the chamber layer. (4) Tubar triradiates, resembling the foregoing, with similar very long basal rays. (5) Subdermal sagittal triradiates; with very widely extended oral rays lying in the dermal cortex, and long straight basal ray extending inwards through the chamber layer; oral rays up to about 0.2 by 0.01 mm.; basal ray up to about 0.32 by 0.01 mm.; all sharply-pointed. (6) Dermal triradiates; sagittal, resembling the foregoing, but often very irregular and with shorter basal ray. (7) Dermal oxea; long, straight or slightly curved, spindle-shaped, gradually sharp-pointed at each end, length variable, up to about 0.7 by 0.016 mm. in the largest specimen, but much longer and slenderer in one of the smaller ones. The spicules of the oscular fringe do not differ markedly from these.

*Locality.*—Near Port Phillip Heads (Station 9, coll. J. B. Wilson).

57. *Grantessa poculum*, Poléjaeff, sp.

*Amphoriscus poculum*, Poléjaeff. Report on the Calcarea of the Challenger Expedition, p. 46.

*Heteropia patulosculifera*, Carter. Annals and Magazine of Natural History, July 1886, p. 49.

A careful examination of portions of Carter's and Poléjaeff's type specimens from the British Museum has convinced me that the two are specifically identical, and

I therefore revert to the earlier specific name. I have also two other specimens collected by Mr. Wilson, one of which exhibits very beautifully the "agglomerated" character mentioned by Carter, while the other is only a fragment. The quadriradiates mentioned by Carter are scarce and inconspicuous, and I have not noticed them in the other specimens.

*Localities.*—Off Port Jackson (Poléjaeff); near Port Phillip Heads (Carter and coll. J. B. Wilson).

58. *Grantessa erinaceus*, Carter, sp.

*Leuconia erinaceus*, Carter. *Annals and Magazine of Natural History*, August 1886, p. 130.

This species is readily recognised by its external appearance and the peculiar arrangement of the dermal oxea. The flagellated chambers are elongated and radial, but very irregular and branching, and they communicate with the gastral cavity by unusually long exhalant canals, which unite together in groups. The tubar skeleton is very irregular, but still presents clear traces of the typical "articulate" arrangement. Subgastral sagittal triradiates are present, and the subdermal sagittal triradiates, with inwardly directed basal rays, are very conspicuous. There is a dense dermal cortex of much smaller triradiates, and a less well-developed gastral cortex. Endogastric septa, without spicules, are present in both my specimens, and, as Mr. Carter also mentions them in his, they would seem to be characteristic of the species.

*Locality.*—Near Port Phillip Heads (Carter, and Station 7, coll. J. B. Wilson).

59. *Grantessa intusarticulata*, Carter, sp.

*Hypograntia intusarticulata*, Carter. *Annals and Magazine of Natural History*, July 1886, p. 45.

*Hypograntia medioarticulata*, Carter, *loc. cit.* p. 46.

I have eleven specimens which I believe to be all referable to this species, and I am strongly of opinion that Mr. Carter's *Hypograntia medioarticulata* is specifically identical with his *intusarticulata*. The minute details of spiculation vary considerable in different specimens, the most characteristic features being the dermal crust of minute oxea or "mortar spicules," and the subdermal sagittal triradiates. The



radial chambers are much branched, which I believe is what Mr. Carter means when he says that they intercommunicate by large holes. The branches run parallel with one another to the dermal cortex; the exhalant canals are short.

*Localities.*—Near Port Phillip Heads (Carter, and Stations 3, 5, 8, 9 and outside the Heads, coll. J. B. Wilson); Watson's Bay, Port Jackson (coll. T. Whitelegge).

60. *Grantessa* (?) *polyperistomia*, Carter, sp.

*Heteropia polyperistomia*, Carter. Annals and Magazine of Natural History, July 1886, p. 47.

*Locality.*—Near Port Phillip Heads (Carter).

61. *Grantessa* (?) *compressa*, Carter, sp.

*Heteropia compressa*, Carter. Annals and Magazine of Natural History, July 1886, p. 51.

*Locality.*—Near Port Phillip Heads (Carter).

62. *Grantessa* (?) *pluriosculifera*, Carter, sp.

*Heteropia pluriosculifera*, Carter. Annals and Magazine of Natural History, July 1886, p. 52.

*Locality.*—Near Port Phillip Heads (Carter).

63. *Grantessa* (?) *erecta*, Carter, sp.

*Heteropia erecta*, Carter. Annals and Magazine of Natural History, July 1886, p. 53.

*Locality.*—Near Port Phillip Heads (Carter).

64. *Grantessa* (?) *spissa*, Carter, sp.

*Heteropia spissa*, Carter. Annals and Magazine of Natural History, July 1886, p. 54.

*Locality.*—Near Port Phillip Heads (Carter).

The last five species are described by Mr. Carter apparently from single specimens, all collected by Mr. Wilson. It appears to me very doubtful whether they are all specifically distinct, and also whether some of them at any rate are not mere varieties of *G. poculum* or *Vosmaeropsis maceva*, which they resemble in spiculation. Unfortunately, I have not seen any of the types.

65. *Vosmaeropsis macera*, Carter, sp.

*Heteropia macera*, Carter. *Annals and Magazine of Natural History*, July 1886, p. 50.

This species is well represented in the collection. I have been able to convince myself of the correctness of the identification by a minute comparison of a piece of Mr. Carter's type from the British Museum. It is remarkable for its densely agglomerated or colonial habit. Specimens may attain a large size, consisting of very numerous individuals almost completely fused together, usually in linear series, which are inter-connected by cross-bars. The oscula are raised on conical prominences, and each indicates a separate gastral cavity. The canal system is remarkable. The chambers are thimble-shaped and mostly widely separated from the gastral cavity, with which they communicate by a strongly developed system of exhalant canals, each being separated from its exhalant canal by a well developed diaphragm. Those chambers which lie next to the dermal surface still exhibit a radial arrangement with regard to the long axis of the individual. Both subdermal and subgastral sagittal triradiates are strongly developed.

*Locality*.—Near Port Phillip Heads (Carter, and coll. J. B. Wilson).

66. *Vosmaeropsis depressa*, n. sp.

Specimen flattened, cushion-shaped, with flat under and convex upper surface. About 12 mm. in horizontal diameter, and only 4 mm. thick in the middle. Margin rounded, roughly circular in outline. There is no wide gastral cavity, but several large, branching exhalant canals converge to a single small osculum situate near the middle of the upper surface. Surface smooth; no distinct oscular fringe.

The inhalant canal-system is quite irregular, commencing in wide lacunar spaces situated beneath the thin, pore-bearing dermal cortex. The flagellated chambers are irregularly but thickly scattered throughout the thickness of the sponge, with no trace of radial arrangement around a central gastral cavity. They are irregularly sac-shaped or thimble-shaped, measuring about 0.2 by 0.09 mm.

The bulk of the skeleton is made up of fairly large, sub-regular or slightly sagittal triradiates, scattered without definite order throughout the thickness of the sponge, but many with one slightly longer ray pointing towards the

dermal surface. Beneath the dermal surface, but apparent only on the upper surface of the sponge, is a distinct layer of subdermal sagittal triradiates with inwardly-directed basal ray. The dermal skeleton is made up principally of subregular triradiates of various sizes, placed horizontally, but with no definite arrangement; amongst these very minute, slender oxea are scattered, rare on the upper surface of the sponge but abundant on the lower; around the osculum these oxea are numerous and a few are much larger than the rest. Around the main exhalant canals there is a layer of small sagittal triradiates. The forms and dimensions of the different spicules are as follows:—(1) Triradiates of the exhalant canals; sagittal, rays conical, fairly sharply-pointed; basal straight, orals usually slightly incurved or recurved; basal commonly somewhat shorter than orals, which measure about 0·16 by 0·012 mm. Just below the osculum I have seen short apical rays in a few of the sagittal radiates. (2) Triradiates of the main skeleton; subregular or slightly sagittal; rays usually straight, conical, gradually sharp-pointed, rather slender, up to about 0·36 by 0·024 mm. (3) Subdermal sagittal triradiates; similar to the foregoing but a good deal smaller, and with the basal ray much longer than the others. (4) Dermal triradiates; subregular, with long, conical, gradually sharp-pointed rays varying greatly in size, up to about 0·54 by 0·045 mm. (5) Oxea; mostly very minute and slender, sharply-pointed at each end, with one end rather thicker than the other; straight; often slightly roughened; usually short, but varying greatly in length; around the osculum a few much stouter ones occur, but still very small.

*Locality*.—Near Port Phillip Heads (Sorrento Reef, coll. J. B. Wilson).

67. *Vosmaeropsis wilsoni*, n. sp.

Sponge colonial, consisting of short, thick, sub-cylindrical or truncatedly conical individuals united together by their bases into smaller or larger agglomerations, which may attain a diameter of nearly five inches. Each fully grown individual has a circular osculum at its summit, which may or may not have an oscular fringe, adjacent individuals of the same colony sometimes differing in this respect. The osculum is often provided with a very distinct, membranous diaphragm, situated a short distance within its margin. The

individuals vary in size, and, owing to their peculiar colonial and branching habit, it is difficult to give exact measurements, but we may put down the average adult size as about 20 mm. long and 5 mm. in diameter. A large colony contains dozens of such individuals united together in a complicated and irregular manner. The outer surface is smooth, except for a slight unevenness due to the presence of large triradiates, visible to the naked eye. The colour of spirit specimens varies from pure white to pale brown, but one specimen which I observed as it came out of the dredge was then of a violet purple colour.

The gastral cavity is wide and cylindrical and the wall is about 2.5 mm. thick. There is a dense, thick cortex on both gastral and dermal surfaces.

The inhalant pores are thickly scattered over the surface of the sponge; each leads separately into a short, narrow, cylindrical canal, situate in the outer portion of the dense dermal cortex; these canals soon unite to form larger, but still very well-defined, cylindrical canals, which anastomose with one another by cross-branches and finally lead down to the chamber layer between the dermal and gastral cortex, where the canal system becomes more or less lacunar. The flagellated chambers are thickly scattered through the mesoderm of the chamber layer; they vary much in shape and size, from approximately spherical and only about 0.072 mm. in diameter to elongatedly sac-shaped and as much as 0.37 by 0.13 mm.\* The exhalant canals unite together into tolerably large trunks, which penetrate the gastral cortex and open into the gastral cavity.

The skeleton is divisible into four portions, that of the gastral cortex, that of the chamber layer, that of the dermal cortex and that of the osculum. The gastral cortex is about 0.3 mm. thick and its skeleton consists entirely of a dense feltwork of medium-sized triradiate spicules, arranged irregularly but parallel to the gastral surface. These spicules are sagittal, the oral angle being rather wider than the paired angles and the oral rays rather longer than the basal; oral rays straight or very slightly curved towards one another, conical and gradually sharp-pointed, measuring about 0.3 by 0.024 mm.; basal ray straight, conical, gradually sharp-pointed, a little shorter than the orals. The

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\* These measurements were taken from different specimens, but it would be difficult to make a mistake as to the species in this particular case, and we also find considerable variation in the chambers even in the same section.

skeleton of the chamber layer is made up of large sub-dermal and subgastral sagittal triradiates, whose basal rays penetrate the chamber layer in opposite directions. These spicules vary greatly in size, the basal rays often extend completely through the chamber layer and are very thick; the oral rays are shorter, more or less curved and widely extended. Frequently many of those which have centrifugal basal rays are not strictly subgastral but have the oral rays situate at various levels in the chamber layer. The rays are conical and gradually sharp-pointed. The dermal cortex is about 0.4 mm. thick and its skeleton is made up almost entirely of triradiate spicules of various shapes and sizes. Towards the inside we find large, regular or subregular triradiates, arranged parallel to the dermal surface, with conical, gradually sharp-pointed rays which measure up to about 1.0 by 0.17 mm.; many, however, being much smaller. On the outside is a much thinner layer of very different, small triradiates. These spicules are irregular in shape and irregularly arranged; their rays are conical and gradually sharp-pointed, but crooked; one of them commonly projects inwards at right angles to the dermal surface; the rays measure about 0.083 by 0.0052 mm. We also find in the outermost part of the dermal cortex a few very minute, straight, slender oxea, whose exact size and shape are very difficult to determine. The oscular skeleton consists of a fringe (not always visible to the naked eye but sometimes strongly developed) of very long and very slender oxea.

I have much pleasure in dedicating this very remarkable and abundant species to Mr. J. Bracebridge Wilson, who has collected all the specimens at present known.

*Locality.*—Outside Port Phillip Heads (coll. J. B. Wilson).

68. *Heteropegma nodus gordii*, Poléjaeff.

*Heteropegma nodus gordii*, Poléjaeff. Report on the Calcareo of the Challenger Expedition, p. 45.

The only specimen which I have seen of this species, unless indeed *H. latitubulata* be considered specifically identical, is a portion of Poléjaeff's type specimen in the British Museum. I have nothing to add to Poléjaeff's excellent description.

*Locality.*—Torres Straits (Poléjaeff). Poléjaeff also records the species from the Bermudas.

69. *Heteropegma latitubulata*, Carter, sp.

*Clathrina latitubulata* (provisional, incertæ sedis), Carter. *Annals and Magazine of Natural History*, June 1886, p. 515.

After describing the external form and spiculation of this remarkable sponge, Mr. Carter remarks that in general form it is very much like Poléjaeff's *Heteropegma nodus gordii*, but totally different anatomically. I have fortunately been able, owing to the kindness of the authorities of the British Museum, to make a minute anatomical examination both of Poléjaeff's type of *Heteropegma nodus gordii*, and also of Carter's type of *Clathrina latitubulata*, and I have also received the latter species direct from Mr. Wilson. I find that in external form, canal-system, and also in the arrangement of the skeleton, the two species are identical, agreeing with the admirable figures given by Poléjaeff in his Challenger Report. The only difference which I have been able to detect concerns the size and shape of the minute quadriradiate spicules of the chamber layer, which are even further reduced in *H. latitubulata* than they are in *H. nodus gordii*.

*Locality*.—Near Port Phillip Heads (Carter, and Station 1, coll. J. B. Wilson).

70. *Amphoriscus cyathiscus*, Hæckel.

*Amphoriscus cyathiscus*, Hæckel. *Prodromus eines Systems der Kalkschwämme*. Jenaische Zeitschrift, Vol. 5, part 2, p. 238.

*Sycilla cyathiscus*, Hæckel. *Die Kalkschwämme*, Vol. 2, p. 250.

*Locality*.—South Australia (Hæckel).

71. *Amphoriscus cylindrus*, Hæckel, sp.

*Sycilla cylindrus*, Hæckel. *Die Kalkschwämme*, Vol. 2, p. 254.

*Amphoriscus cylindrus*, von Lendenfeld. *Proc. Linn. Soc. N.S.W.*, Vol. IX, p. 1103.

*Locality*.—Port Jackson (von Lendenfeld. Recorded by Hæckel from the Adriatic).

72. *Leucilla uter*, Poléjaeff.

*Leucilla uter*, Poléjaeff. Report on the Calcarea of the Challenger Expedition, p. 53.

*Polejna uter*, von Lendenfeld. *Proceedings of the Linnean Society of New South Wales*, Vol. IX, p. 1115.

*Localities.*—Torres Straits (von Lendenfeld. Recorded by Poléjaeff from the Phillipine Islands and the Bermudas).

73. *Leucilla imperfecta*, Poléjaeff, sp.

*Leucetta imperfecta*, Poléjaeff. Report on the Calcareous of the Challenger Expedition, p. 67.

*Vosmaeria imperfecta*, von Lendenfeld. Proceedings of the Linnean Society of New South Wales, Vol. IX, p. 1113.

*Locality.*—Off Port Jackson (Poléjaeff).

74. *Leucilla australiensis*, Carter, sp.

*Leuconia johnstonii*, var. *australiensis*, Carter. Annals and Magazine of Natural History, August 1886, p. 133.

This beautiful little species nearly always presents itself under the form of a small, ovoid, sessile, solitary person, with single, circular, naked, terminal osculum. The sponge-wall is comparatively thick, and the dermal surface smooth and hard owing to the large quadriradiates. One very large specimen in the collection, however, is conical in shape, and has a very irregular surface, but this is very exceptional. The species is sometimes social, and rarely consists of two or more individuals united together, or of a single branched individual; but the small egg-like form is highly characteristic. There are numerous specimens in the collection.

The flagellated chambers, thickly scattered through the thickness of the wall, are usually approximately spherical, and about 0.1 mm. in diameter; immediately beneath the dermal cortex, however, they are commonly rather larger and more or less sac-shaped.

*Locality.*—Near Port Phillip Heads (Carter, and Stations 1, 5, 6, 9, coll. J. B. Wilson, and off Geelong, coll. H. Grayson).

75. *Leucilla prolifera*, Carter, sp.

*Teichonella prolifera*, Carter. Annals and Magazine of Natural History, July 1878, p. 35, and August 1886, p. 146.

This beautiful species is represented in the collection by a number of fine examples, one of which I have already figured in my paper "On the Anatomy of *Grantia labyrinthica*, Carter, and the so-called Family Teichonidæ" (*Quarterly Journal of Microscopical Science*, Vol. 32, N.S.) The flagellated chambers are approximately spherical and about 0.09 mm. in diameter, thickly scattered through the substance of the sponge. With the exception of the small quadriradiates in the walls of the oscular tubes, and the very

large quadriradiates of the dermal surface, the skeleton is quite irregularly arranged, consisting of scattered triradiate spicules. On account of the large subdermal quadriradiates, though the inwardly-directed apical ray is but short, I propose to include the species in the genus *Leucilla*.

*Localities*.—Near Port Phillip Heads (Carter, and outside the Heads, coll. J. B. Wilson); Freemantle, W.A. (Carter).

76. *Leucilla saccharata*, Hæckel, sp.

*Leucandra saccharata*, Hæckel. Die Kalkschwämme, Vol. 2, p. 228.

*Leucandra saccharata*, von Lendenfeld. Proceedings of the Linnean Society of New South Wales, Vol. IX, p. 1137.

This remarkable species exhibits a singular irregularity in external form, varying from compressed, irregularly-folded plates to elongated cylindrical tubes, and often attaining a large size. It is common in Port Jackson, whence I have received specimens from Professor Spencer, but I have only seen a single specimen from Port Phillip, collected by Mr. Wilson.

The flagellated chambers are approximately spherical, scattered irregularly, about 0.09 mm. in diameter.\*

*Localities*.—Bass Straits (Hæckel); Port Jackson (von Lendenfeld, and coll. Prof. Spencer); Port Denison (von Lendenfeld); Port Phillip (Station 14, coll. J. B. Wilson).

77. *Leucilla villosa*, von Lendenfeld, sp.

*Leucandra villosa*, von Lendenfeld. Proceedings of the Linnean Society of New South Wales, Vol. IX, p. 1131.

The only specimen of this sponge which I have seen is a piece of the type from the British Museum, in which subdermal quadriradiates, with long, inwardly-directed apical ray, are abundant. I therefore include the species in the genus *Leucilla*.

*Locality*.—Port Jackson (von Lendenfeld).

78. *Paraleucilla cucumis*, Hæckel, sp.

*Leucandra cucumis*, Hæckel. Die Kalkschwämme, Vol. 2, p. 295.

*Localities*.—Bass Straits and Gulf of St. Vincent (Hæckel). Also recorded by Hæckel from Ceylon.

\* Von Lendenfeld gives the diameter as 0.04 mm., but this is probably an error, for he also says that in *Leucandra typica* the chambers "are smaller than in any other case, their diameter rarely exceeding 0.04 mm." (*loc. cit.*, p. 1130).